RECORDALARM

SEQUENTIAL EVENT RECORDER

THE LUNDELL RECORDALARM SOLID STATE EVENT RECORDER

MODEL 221

Since 1958, Lundell Controls Inc. has specialized in the coordination, design and layout of complete annunciator and event recorder systems, starting with the requirements for this equipment by public utility generating plants, substations and related process industries. Lundell has more event recorders in the field than any other manufacturer. Our long experience, engineering skill, and Lundell's high standards of excellence are your complete assurance of long, trouble free service and thorough dependability.

WHAT IT IS AND WHAT IT DOES

The LUNDELL Model 221 RECORDALARM is a sequential events recorder that continuously monitors a variety of points and prints out an immediate record of abnormal operating conditions.

It provides a printed record identifying the point where the abnormal condition occurred and the time of occurrence. When conditions at a point return to normal, the RECORDALARM also prints a record identifying: (1) the *point* which returned to normal; and (2) the *time* at which the point returned to normal.

MULTIPLE ABNORMAL OR RETURN TO NORMAL CONDITIONS

If abnormal conditions occur at a series of points or a series of points return to normal, the RECORDALARM prints a record of the events in the sequence in which they occurred. The record identifies: (1) each point; (2) the time at which the first event occurred; and (3) the elapsed time between subsequent events.

MANY APPLICATIONS FOR RECORDALARM

RECORDALARM sequential event recorders are ideal for monitoring any system containing a large number of operating variables where monitoring can be accomplished on a normal-abnormal basis.

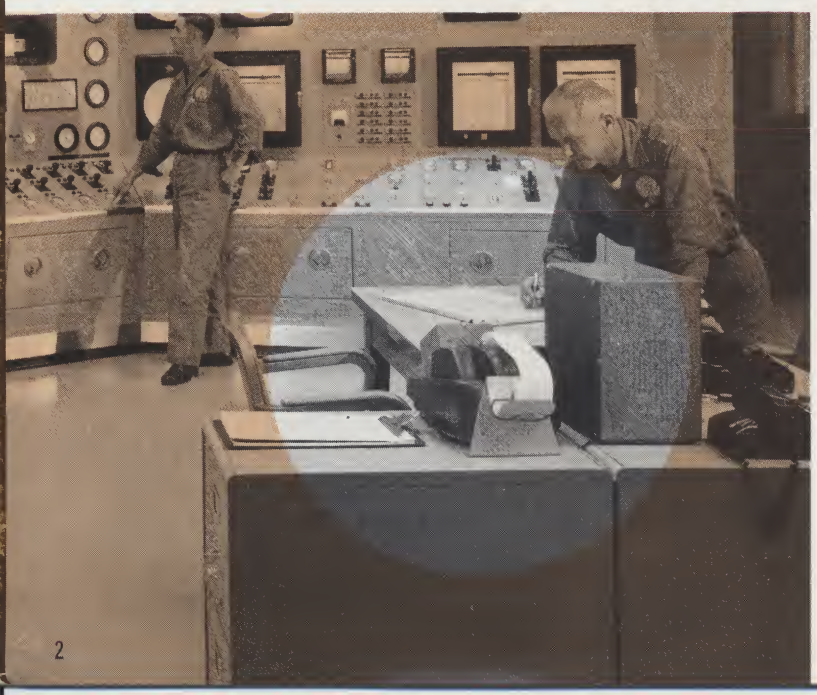
Now finding extensive use wherever automatic operations are carried out, RECORDALARMS are invaluable for use with automated production lines in manufacturing plants and process controls in the chemical and petroleum industries.

NEEDED IN ADDITION TO COMPUTER

The existence of a computer does not change the need for RECORDALARM. As a "hard-wired" fixed program device, RECORDALARM can monitor a large number of points at a considerably lower cost than a computer—and does not require programming. In addition, the printing out of alarms does not require a program interrupt, and RECORDALARM can be maintained by normal plant operating personnel.

CAN BE INTERFACED

For installations where a computer is in use, RECORDALARM can be interfaced with the computer. Contact your LUNDELL representative for additional information if application with a computer is of interest.



OPERATING ADVANTAGES OF RECORDALARM SYSTEM

The advantages of RECORDALARM are many and depend on the requirements of the specific installation. Here are some of the many ways that RECORDALARM can be used for maximum results.

IMMEDIATE RECORD OF MALFUNCTION

When a malfunction occurs, RECORDALARM immediately pinpoints the location of the malfunction—saving valuable time that would otherwise be expended checking equipment which is operating properly.

ACCURATELY IDENTIFIES CHAIN REACTION

Where a malfunction can cause a chain reaction of events, the RECORDALARM printed record immediately pinpoints the initial cause of the trouble and *each place* where a malfunction occurred. This not only saves time in putting the equipment back in service, it also prevents defective equipment from inadvertently being put back into service and causing another chain reaction of malfunctions.

PRINTED RECORDS FOR REFERENCE

In addition, the unbiased printed record provided by RECORDALARM allows management to readily determine: (1) the effectiveness of the preventive maintenance program; and (2) when equipment is reaching the end of its useful life and should be replaced.

SIMPLIFIES ANNUNCIATOR INSTALLATIONS

RECORDALARM allows for simplification—or even elimination—of visual annunciator installations, since all alarms are immediately recorded in order of occurrence.

If a visual annunciator is desired for backup, input points can be combined into groups with one annunciator window used for each group of points. Individual point identification will be provided by the RECORDALARM.

Some of the variables that RECORDALARM monitors in power generating stations are:

ELECTRICAL GENERATOR

- Generator starts in service
- Generator goes out of service
- Stator winding temperature
- Field winding temperature
- Bearings temperature
- Oil pressure
- Excessive oil in bearing oil reservoir
- Insufficient oil in bearing reservoir
- Excessive speed
- Insufficient speed
- Excessive output voltage
- Insufficient output voltage
- Excessive load current

FURNACE

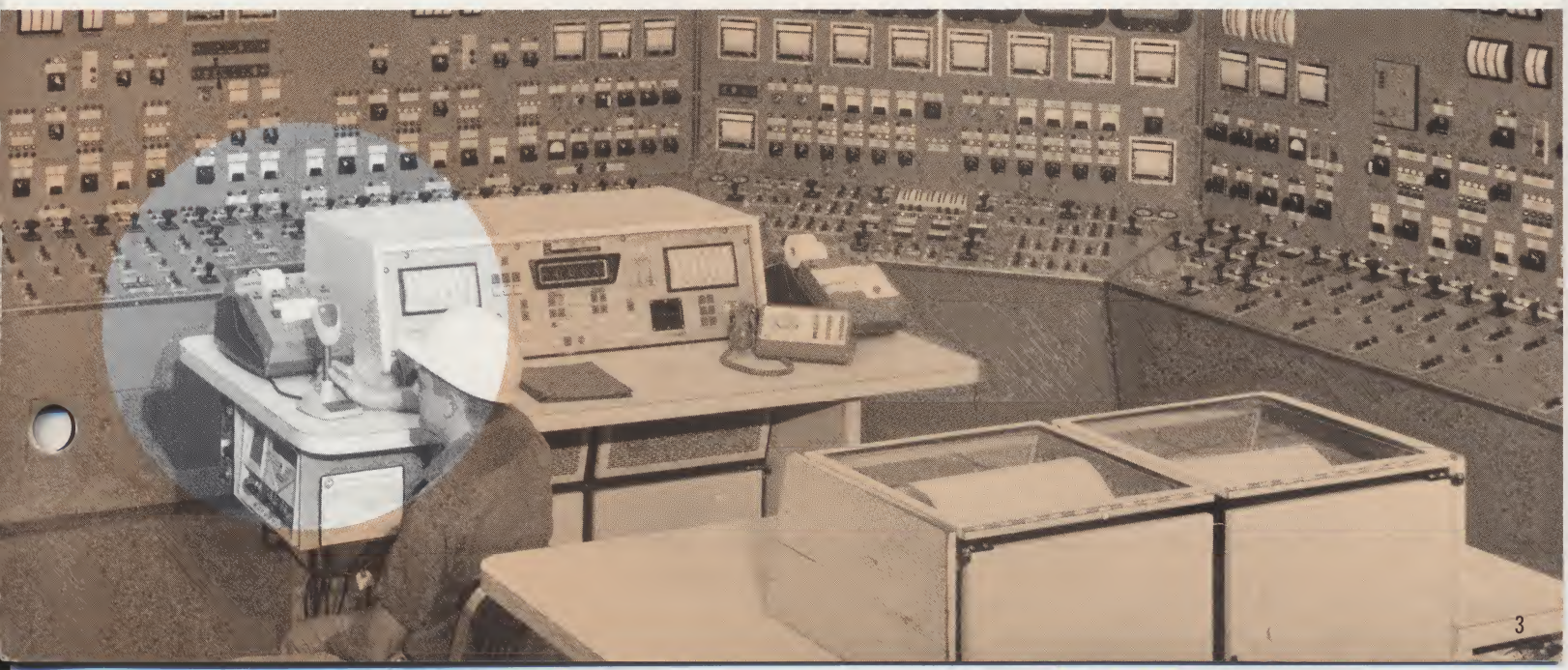
- Exhaust hood temperature
- Fan motor in service
- Boiler pressure
- Boiler temperature

TURBINE

- Bearings temperature
- Oil pressure
- Excessive oil in bearing oil reservoir
- Insufficient oil in bearing oil reservoir

TRANSFORMER

- Low inert gas pressure
- Low oil level
- Temperature
- Failure



DESCRIPTION

The RECORDALARM is housed in floor standing steel cubicles having front and rear access doors that are easily removed. The cubicle sides are constructed of 16-gauge steel and the top and doors of 11-gauge steel. The number of cubicles is determined by the number of input points to be monitored; cubicles are bolted together to form an integral unit. The finish is gray ASA #61 baked enamel outside and white inside. Cable entrances are provided at either the top or bottom of the input terminal cubicle.

Figure 2 shows a typical Model 221 RECORDALARM with 100 input points and five levels of memory. Space has been provided for future expansion.

FIGURE 1. Two cubicle RECORDALARM

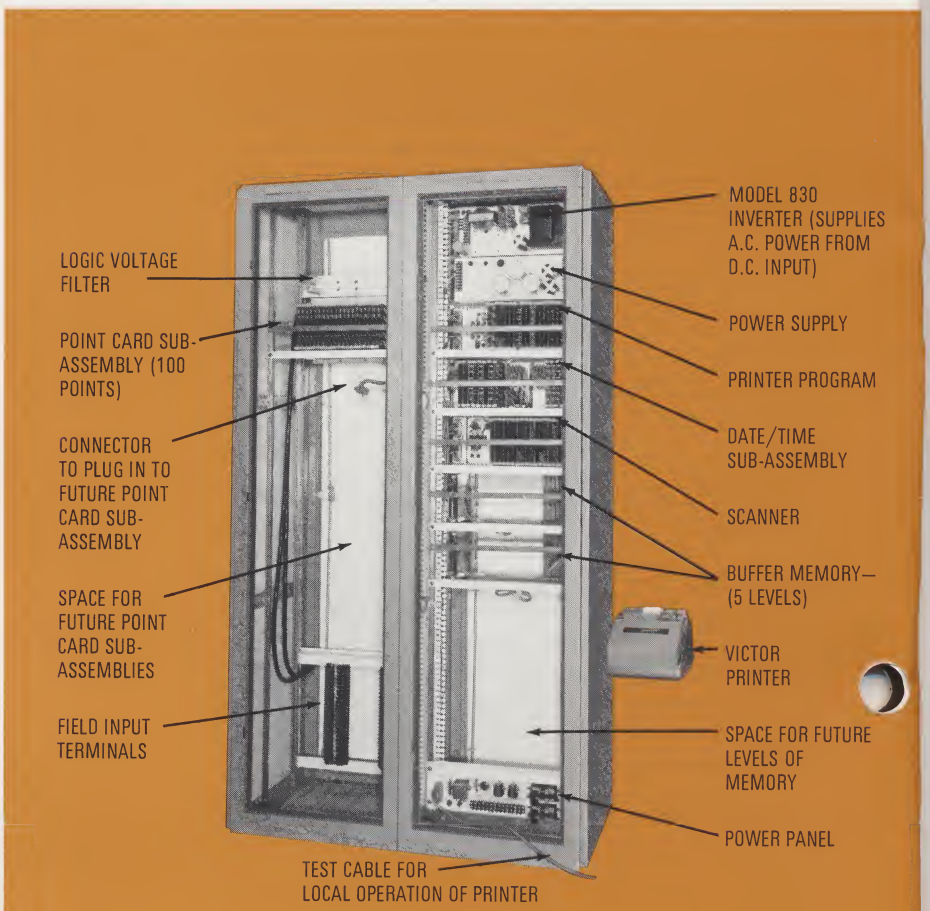
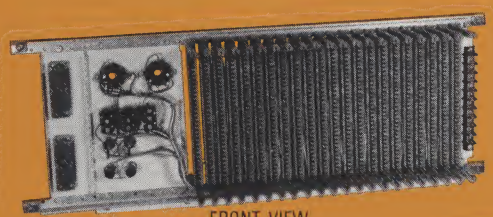
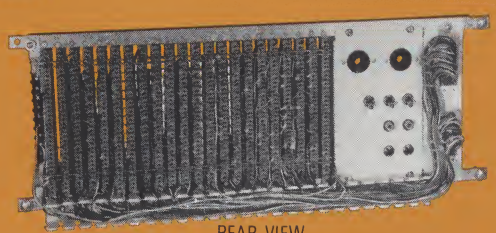


FIGURE 2. Front view of two cubicle RECORDALARM with front doors removed



FRONT VIEW
with printed circuit cards removed



REAR VIEW

FIGURE 4. The scanner is typical of the construction and wiring used in the Model 221 RECORD-ALARM

FIGURE 5.

Figure 3 shows a typical Model 221 RECORDALARM with 100 input points and 10 levels of memory. Space has been provided for expansion to 500 input points and 20 levels of memory. The unit shown in Figure 2 has input connections for the RECORDALARM only, while the unit shown in Figure 3 is used with STATALARM integral annunciators and requires a more complex input terminal arrangement.

Maintainability and expandability are important features of RECORDALARM internal construction. Electrical sub-assemblies are mounted on chassis which are bolted in place; active circuits are mounted on plug-in printed circuit cards. The chassis and printed circuit cards are removable and interchangeable.

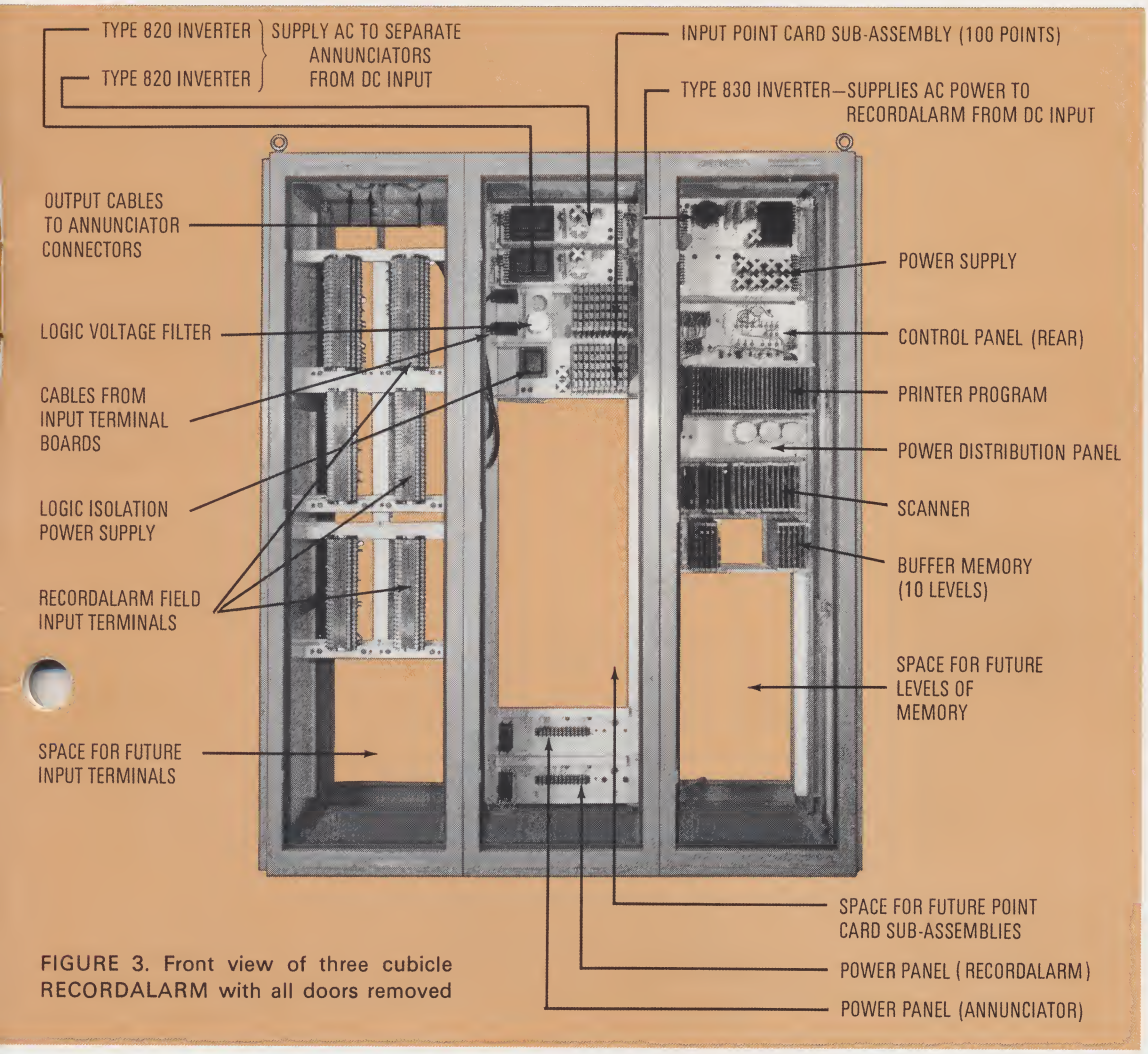


FIGURE 3. Front view of three cubicle RECORDALARM with all doors removed

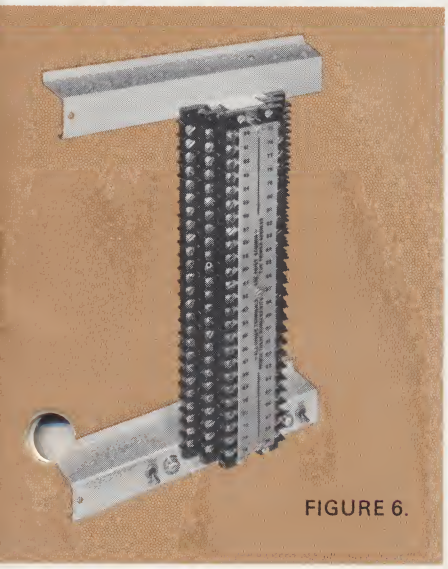
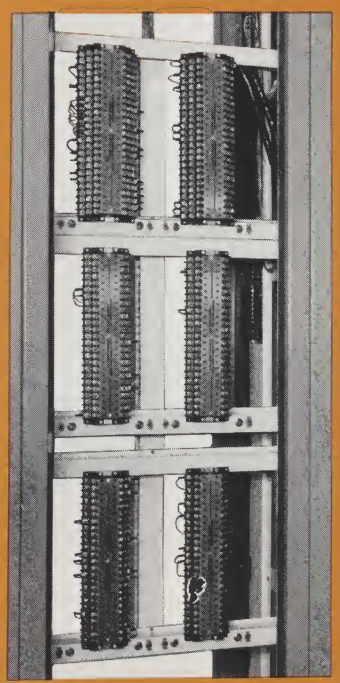


FIGURE 6.

FIGURE 5. Where field contacts connect to RECORDALARM inputs only, the two-stack terminal arrangement is used. The terminal strip assembly accommodates 50 sets of field contacts. The toggle switch removes the voltage from the 25 sets of contacts on one side of the terminal strip assembly and is used when checking for grounds in the field wiring. The pilot light indicates the presence of voltage on the associated group of field contacts. A second toggle switch (not shown) controls the voltage to the contacts on the other side of the terminal strip assembly

FIGURE 6. Where field contacts are shared by an annunciator and the RECORDALARM, the three-stack arrangement is used. The terminal strip assembly accommodates 50 sets of field contacts

FIGURE 7. Closeup of an input terminal cubicle. The bottom two rows of terminal strip assemblies (200 sets of field contacts) are for contacts used with an annunciator or the RECORDALARM only. The top row of terminal strip assemblies (100 sets of field contacts) are for contacts shared by an annunciator and the RECORDALARM

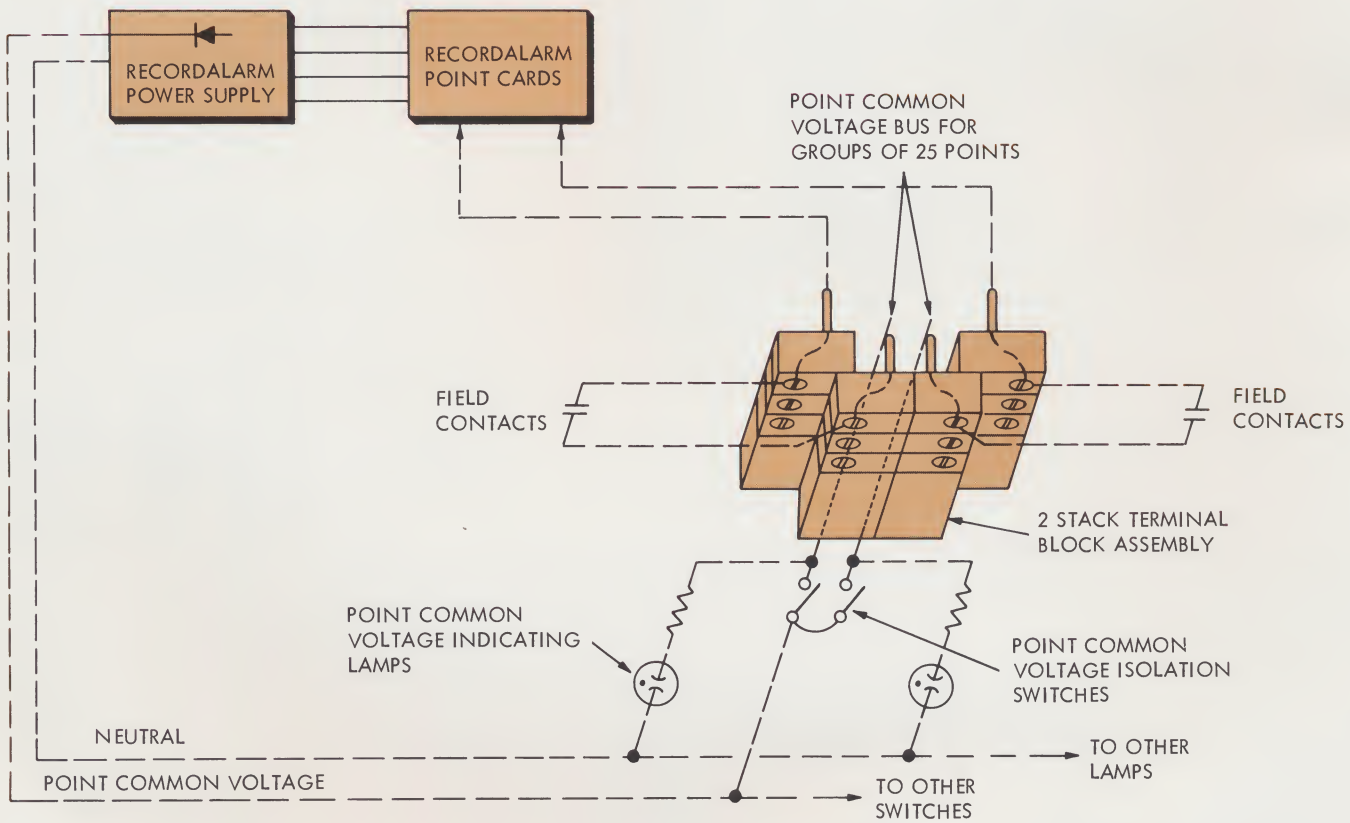


FIELD WIRING

Figure 8 illustrates the typical hookup in a system where field contacts connect to RECORDALARM inputs only. In this type of system the two-stack terminal block assembly is used for field contact connections. Field contact wiring is normally supplied by the user. Operating the field contacts causes the input point to be recorded.

Figure 9 illustrates the hookup in a system where input points are either recorded or annunciated. Operating the contact shown on the left side of the terminal block assembly causes the associated input point to be recorded. Closing either set of contacts on the right side of the

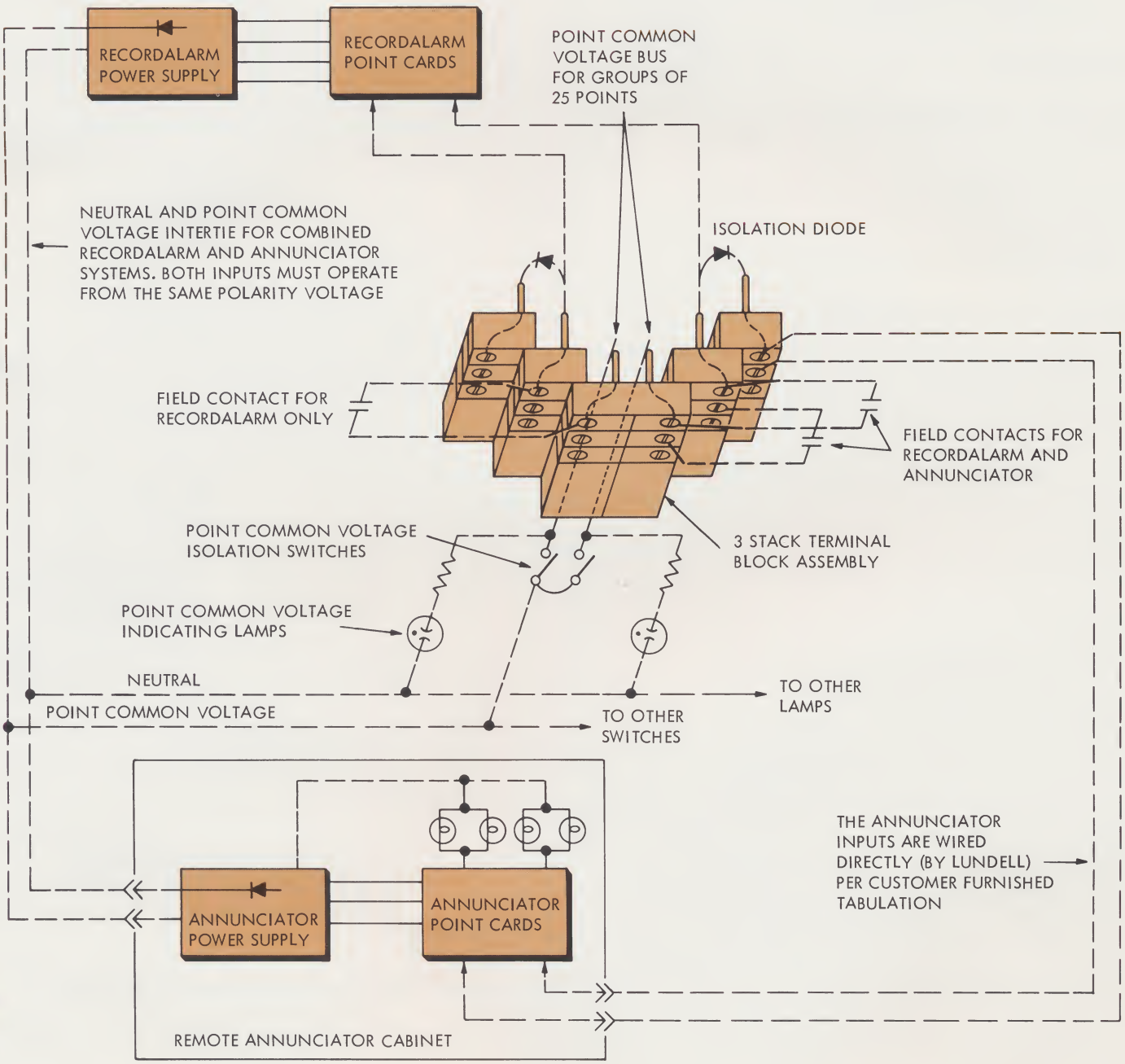
FIGURE 8. Typical field contact wiring for RECORDALARM only



assembly causes the associated input point to be recorded as an "abnormal" condition and operates the associated annunciator point. Opening the contacts causes the point to be recorded as a "return-to-normal" condition and reverts the associated annunciator point. The RECORDALARM input point cards can be changed to operate from normally closed contacts instead of the normally open contacts shown.

In this type of system the three-stack terminal block assembly is used for field contact connections. Where this is done, both inputs must operate from the same polarity

FIGURE 9. Typical field contact wiring for systems where points are recorded or recorded and annunciated—one for one



voltage. The power supply neutrals must be connected to each other and the point common voltage outputs are usually tied together. Field contact wiring is supplied by the user, while the annunciator inputs are normally wired directly, by LUNDELL, according to a tabulation supplied by the user.

The contacts that initiate operation (in all three systems) are usually part of the user's equipment. However, inputs responsive to voltage or current can be provided by LUNDELL. Current-carrying circuits such as circuit breaker trip coils can be monitored without physical connection into the circuit by LUNDELL's exclusive D.I. coil input point system.

CONTACT INPUTS

Input circuits operate identically from either normally open or normally closed field contacts, and can be changed in the field without a wiring change.

RESPONSE TIME

Input circuits respond to any change in state of the field contacts lasting more than three-milliseconds, and are not affected by noise or contact bounce lasting up to 30-milliseconds. Changes are memorized until reset by printout, so it is impossible to lose an alarm. Where contacts are known to cycle or chatter for extended periods, LUNDELL number 209 "Return-to-normal" delay module is available to prevent unnecessary printouts.

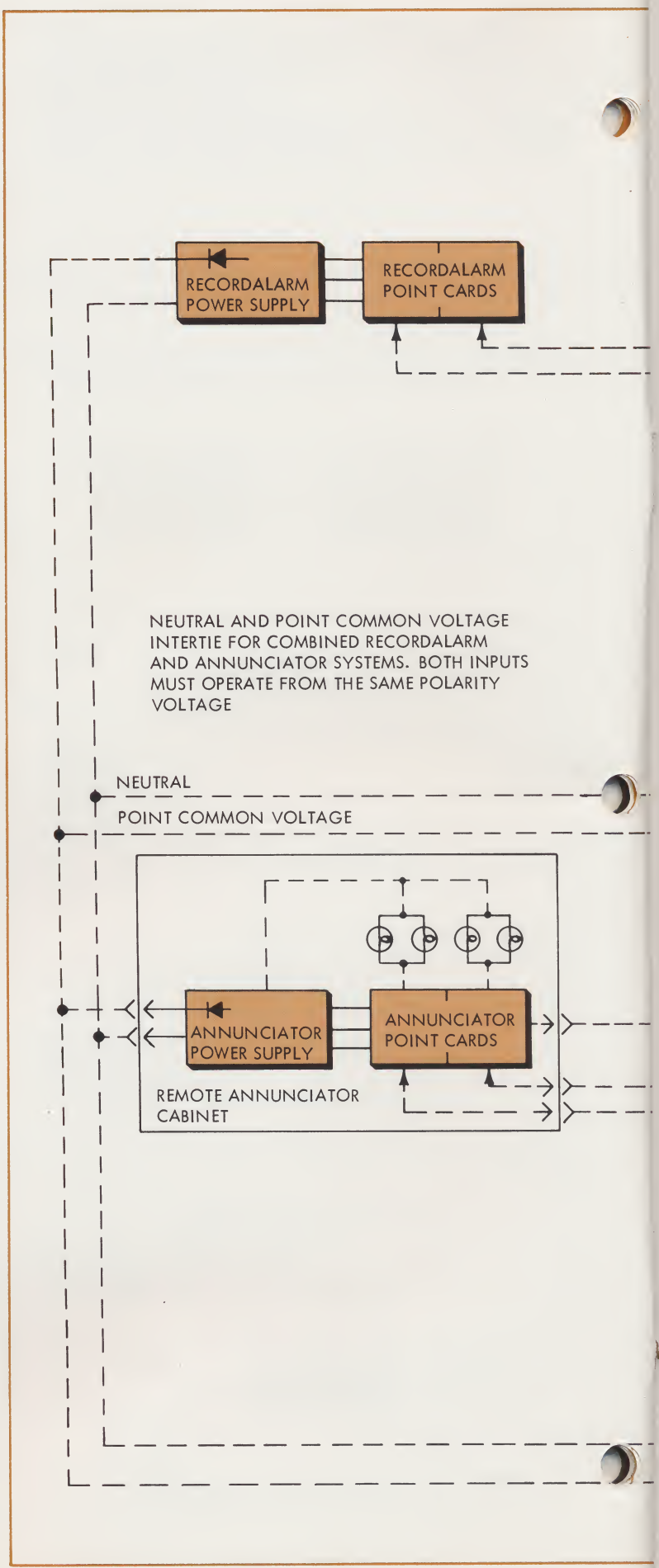
CONTACT OPERATING VOLTAGE

The field contact operating voltage is supplied from an internal power supply and is fully isolated from external circuits. The nominal 140 v.d.c. insures proper operation of the contacts while current limiting insures long contact life.

Figure 10 illustrates a more complex system hookup that combines the two-stack terminal block assembly of Figure 8 with the three-stack terminal block assembly of Figure 9.

Detail B shows four sets of field contacts connected to a three-stack terminal block assembly. One set of field contacts is recorded only. One set of field contacts is connected directly to both the recorder and the annunciator and operation is recorded and annunciated as an individual point (the same as the contacts in Figure 9).

The remaining two sets of field contacts are each recorded as individual points. Their associated terminals on the terminal strip are connected together by a jumper and connected through the two-stack terminal block assembly in detail A to the annunciator as one annunciator point. The set of field contacts in Detail A is annunciated only. Interconnection to the annunciator (where shown) is normally through a cable supplied by LUNDELL. Field contact wiring is supplied by the user. Both the RECORDALARM and the annunciator must operate from the same polarity voltage. The power supply neutrals must be connected to each other and the point common voltage outputs must be tied together.



RECORDALARM

FIGURE 10. Typical field wiring for systems where points are recorded, annunciated, or recorded and annunciated by groups

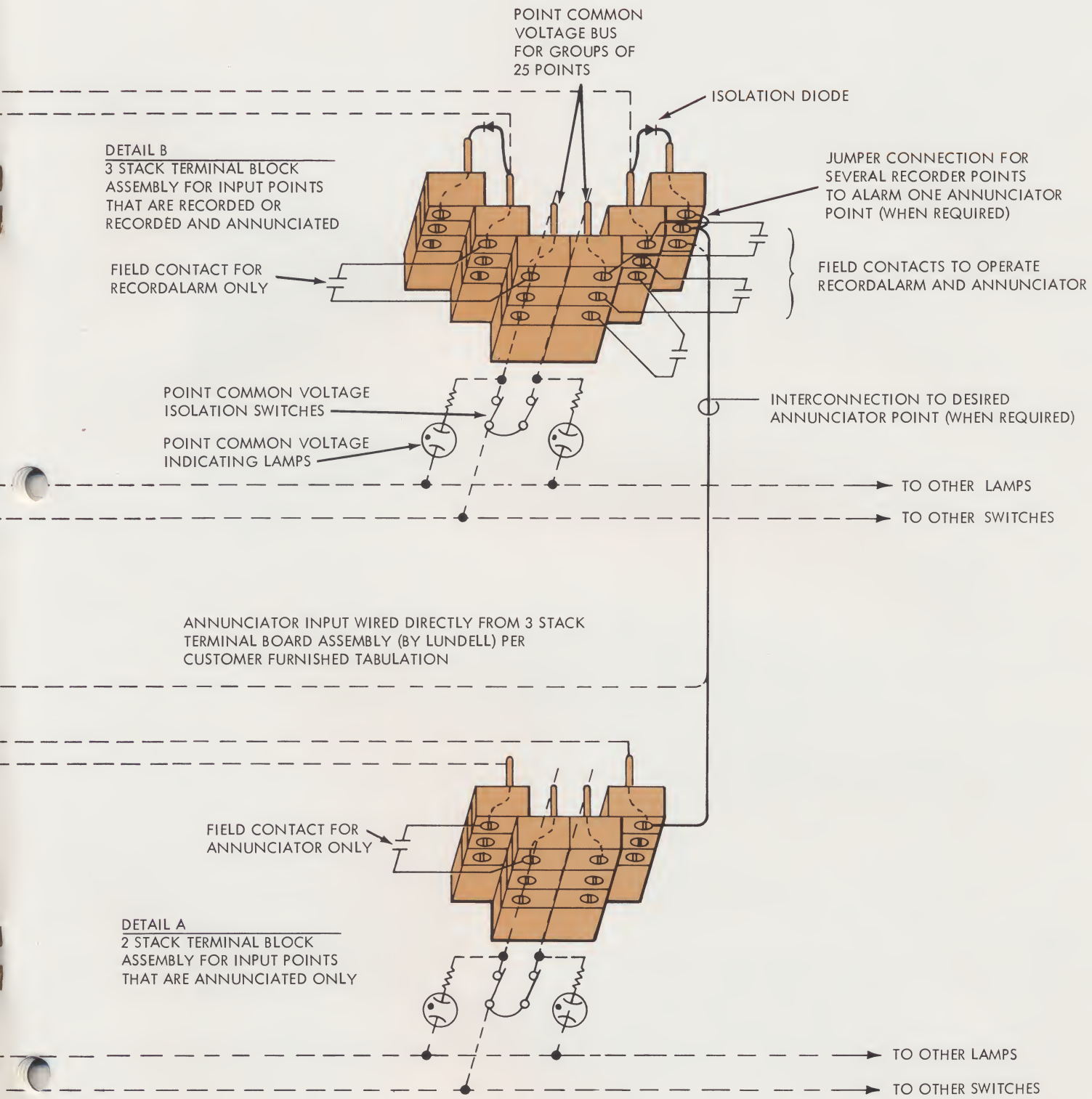


FIGURE 11. The DI COIL and its related circuitry is an input device for alarm systems which performs the same basic function as a field contact. Operation is analogous in that it represents a high impedance with no DC current flowing in the field wire, and a low impedance with DC current flowing.

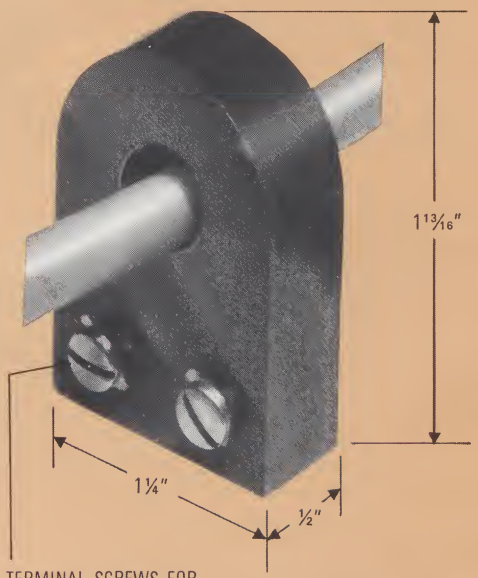
The DI COIL system is an effective, inexpensive means of monitoring direct-current circuit functions previously costly or inaccessible to monitor.

Note that it monitors any direct current circuit without altering the circuit characteristics.

The oscillator P. C. card generates a high frequency AC signal which normally does not appear at the input of the DI COIL input card due to the high impedance of the unsaturated DI COIL. When the latter is saturated by DC current flowing in the field conductor, AC voltage appears at the input of the DI input point card. The AC is then converted to DC and turns on transistor Q1. If a RECORDALARM only is in use, the resulting 10 V signal is fed directly to the corresponding RECORD-ALARM input point card.

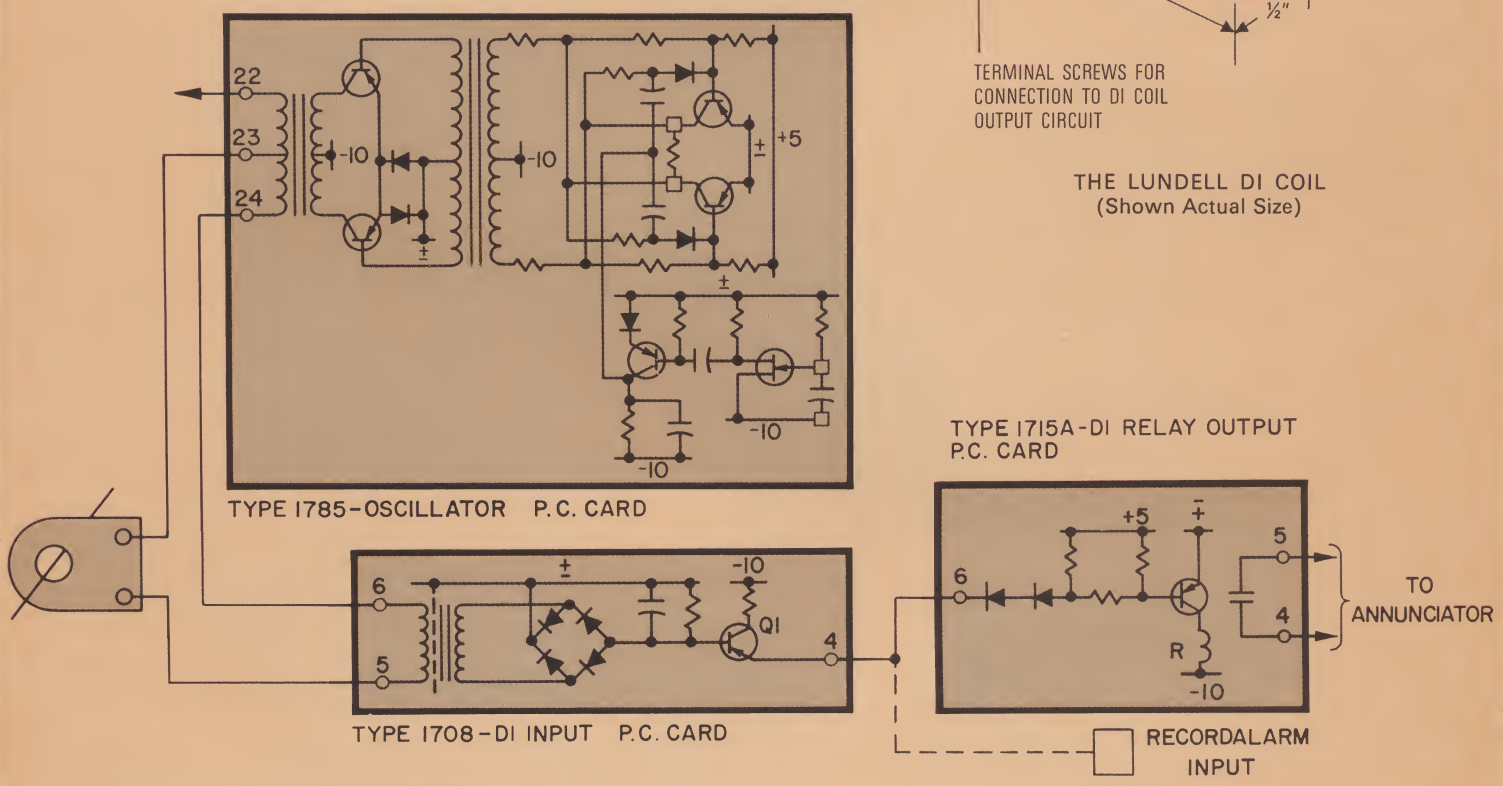
If a STATALARM is used in conjunction with the RECORDALARM, the 10 V signal is also used to turn on the transistor in the DI relay output P. C. card. This pulls in relay R, closing N. O. contacts 4 and 5. This contact closure operates the corresponding STATALARM input point card.

Normally the system alarms on the presence of DC current in the field conductor. However, by operating a simple switch on the DI input P. C. Card, the logic can be inverted and the system will alarm on the absence of DC current in the field conductor.



TERMINAL SCREWS FOR CONNECTION TO DI COIL OUTPUT CIRCUIT

THE LUNDELL DI COIL
(Shown Actual Size)

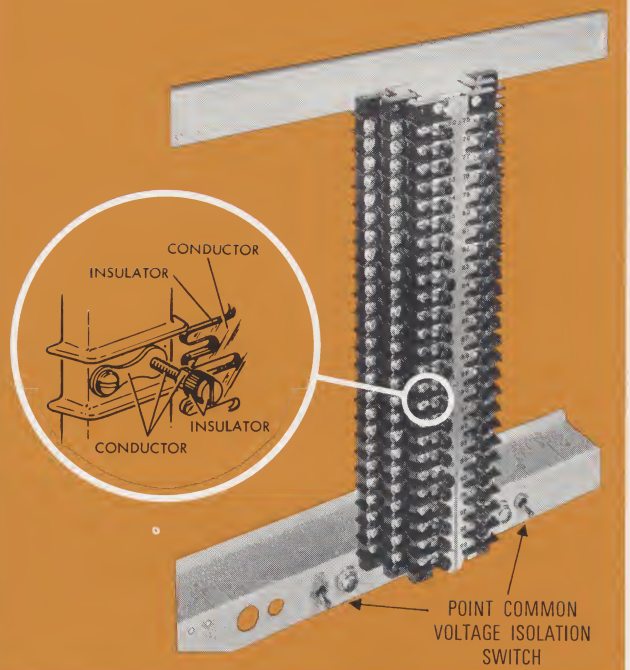


GROUND DETECTION AND LOCATION

Because of the extensive field wiring done at the user's site, the detection and isolation of grounds in the field wiring can be a major task during startup. The ability to detect and isolate grounds on this wiring is an important plus built into every Lundell RECORDALARM. Since all circuits are isolated, the input of a selected point may be connected to station ground. When a ground occurs in the field wiring, an off-normal printout occurs for that point. To simplify the problem of locating grounds, there are never more than 50 sets of contacts to a terminal strip assembly and each terminal strip assembly is further divided into two groups of 25 sets of contacts by the point common voltage isolation switches.

To further simplify ground detection, the Model 222 manual disconnect terminal assembly, shown in Figure 12, is available as an option. This LUNDELL exclusive feature completes the circuit to each field contact from the point common voltage through a shoulder screw assembly with a knurled plastic head. After the terminal group with the ground is located with the point common voltage isolation switch, each field contact connection in the group may be broken by manually backing out the screw assembly, greatly reducing the time required to trouble shoot field wiring.

FIGURE 12. Model 222 manual disconnect terminal assembly



POWER SOURCE

95-130 v. a.c., single-phase, 60 cycle, or 90-143 v. d.c.

As a special feature, the RECORDALARM can be operated from either an a.c. or d.c. source, with either source the preferred and the other the backup. Transfer between sources is automatic and operation is not affected by the transfer. A white pilot light illuminates to indicate operation from the preferred source and a red pilot light illuminates to indicate operation from the backup source.

DIGITAL CLOCK

Real time is provided by a solid state, 24-hour clock which times from an 115 v. a.c., 60-cycle input. The clock contains its own internal oscillator and will continue accurate operation during a power failure. Manual controls are provided to correct the clock if necessary after loss of power. (Figure 14).

TESTS, FEATURES AND CONTROLS

Although routine operation of the Model 221 RECORDALARM is fully automatic, a complete set of features is provided to optimize operator utilization. Stored data is immediately available by manual command, and extensive self-checking programs with visual indication are included.

Operational Test

Actuating the TEST PB at the printer (Figure 13) causes the unit to print out "alarm" and "return-to-normal" for point 000, serving as a fast operation check of the logic.

Event Indication Light

A pilot light is provided at the printer to indicate when an event has been recorded. Indication continues until acknowledged by actuation of the RESET PB.

FIGURE 13. The standard output device on the Model 221 is a Victor Digitmatic Printer. Controls and indicators are installed by Lundell. This printer is a rugged model designed for continuous duty, and is backed by a world-wide service organization. A paper take-up reel is available as an option. All units are equipped with two printer cables. One is a 10 foot test cable provided so the printer may be operated adjacent to the unit for test purposes. The other is the printer operating cable which is 50 feet long unless specified differently by the purchaser.

Time and Date Check

When the date option is included, a pushbutton labeled DATE is provided on the printer program sub-panel. Actuation of the DATE PB provides an "on demand" printout of the hour, the day, the month, the last two digits of the year, and the operation code "D."(Figure 14).

Automatic Printer Check

The real time is printed out once each hour to provide automatic verification of system operation. As an option, the date may be included in the printout.

Printer Program Check

Actuation of the LOG TEST PB on the printer program sub-panel (Figure 14) initiates execution of the printer program. Correct operation is indicated by printout of time followed by a predetermined number.

Input Points Check

In the past, checking proper operation of the input circuits required sequential printout of all points, which tied up the unit for an extended period of time. With the LUNDELL input point check, actuation of the INPUT CHECK PB on the scanner sub-panel simulates an off-normal condition at all inputs, and the unit will print out the address of ONLY THOSE POINTS WHICH FAIL TO OPERATE PROPERLY. This is a complete functional test of the input points.

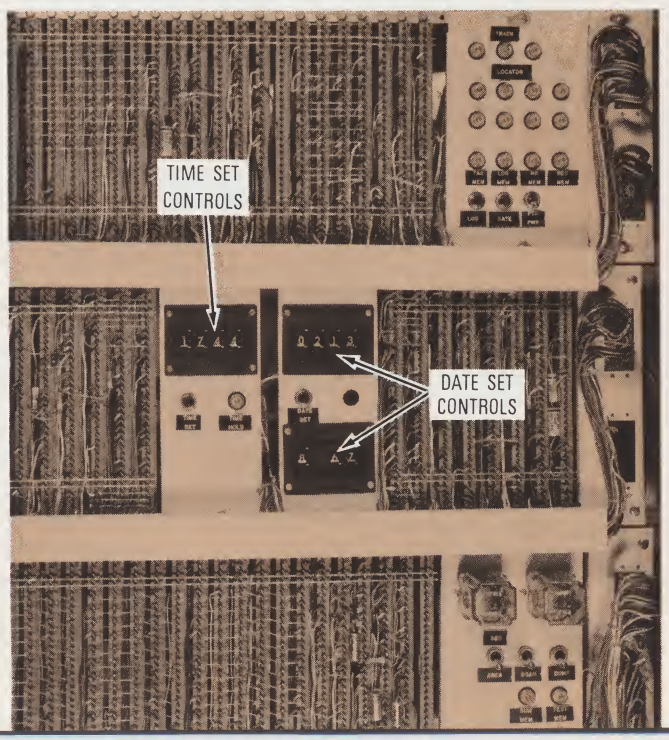
Time and Date Controls

Thumb-wheel switches with indicator lights are mounted on the TIME SET and DATE SET sub-panels to individually adjust time and date.(Figure 14).

Off-Normal Summary

Actuating the SUM PB on the scanner sub-panel causes the unit to immediately print out all points in alarm.

FIGURE 14. Control sub-panel



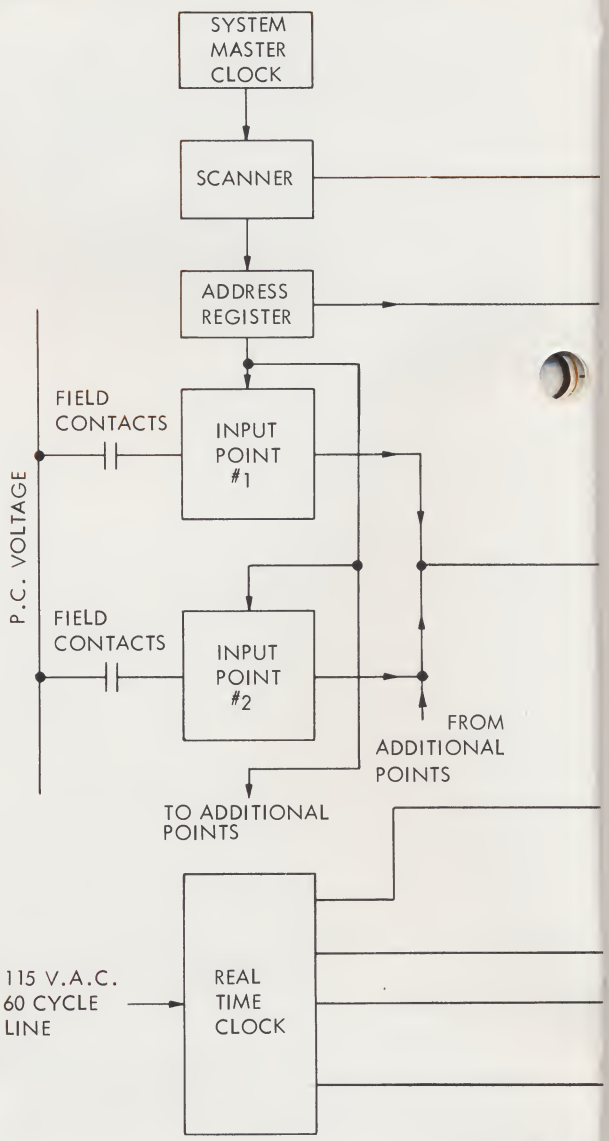
OPERATION

EVENT RECORDING

Events are recorded in two types of sequences: (1) the NORMAL sequence, where the time between events exceeds the printout time for one event; and (2) the HIGH SPEED sequence, where two or more events occur before a printout can be completed.

Normal Sequence

In a NORMAL sequence, events are printed out in order of occurrence. The real time (in hours, minutes and seconds), the operation code (A = alarm, N = return-to-normal) and the three digit point address are printed out for each event.



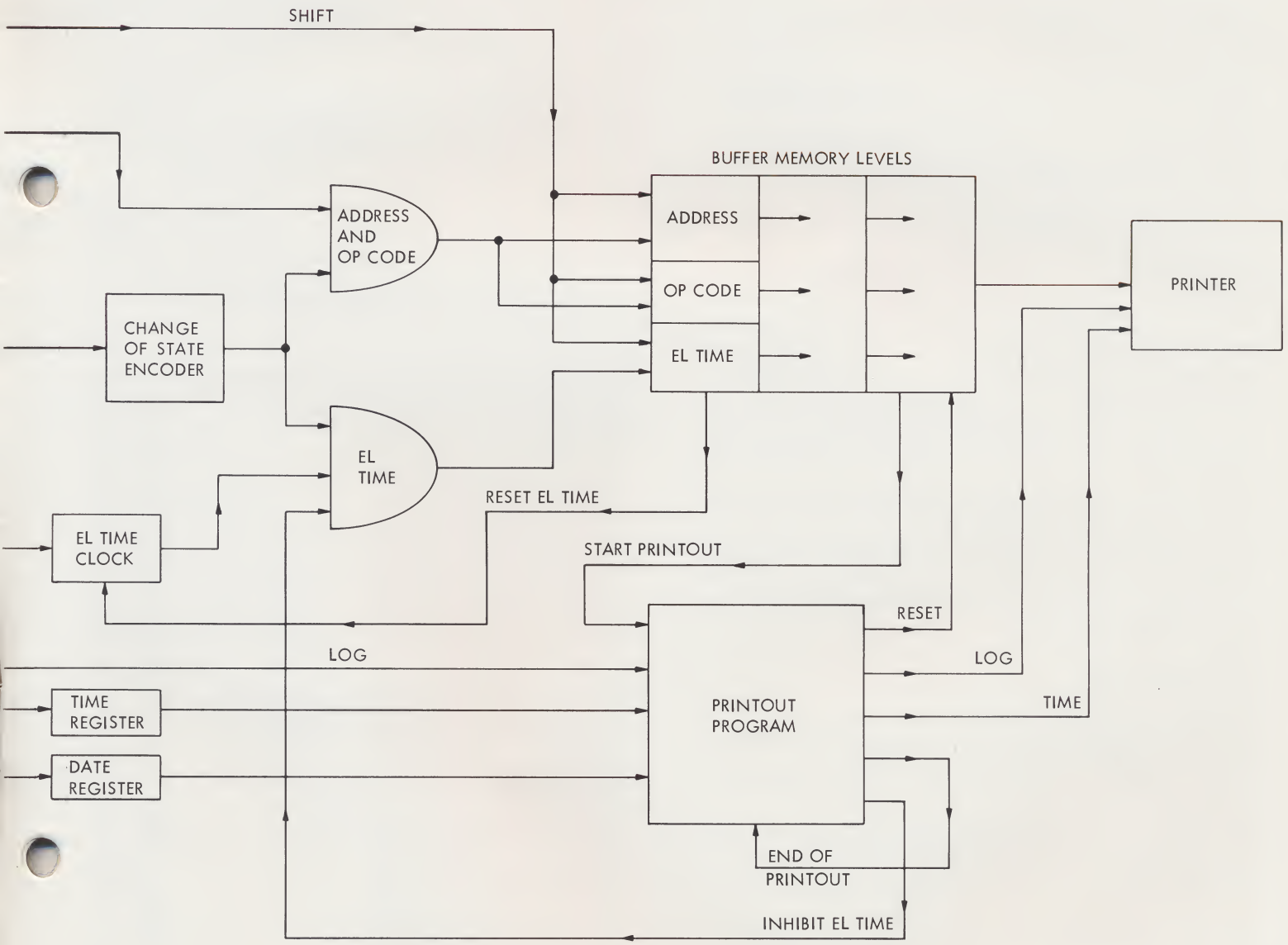
Referring to the block diagram, the system master clock drives the scanner, which continuously advances the address register. At each step of the scan the address register interrogates an input point, and at the same time provides an input to the address and op code (operation code) gate. If the input point under interrogation has had a change of state, an output is developed which enters the change of state encoder. The change of state encoder determines if the input is an alarm (A) or a return-to-normal (N) and transfers the data through the address and op code gate to the first level of buffer memory.

The change of state encoder also provides an input to the el time (elapsed time) gate. However, since the printout program is not operating, the printout program provides an inhibit to the el time gate and no output is developed.

The address and op code are shifted through the buffer memory levels by the shift inputs from the scanner. When the data arrives at the highest level of memory, the latter causes a start printout signal to be applied to the printout program to initiate printout.

The output of the real time clock is applied through the time register and the date register (if included) to the printout program. The printout program supplies the time and date data directly to the printer where it is printed along with the data in the highest level of memory. After the completion of printout, the printout program resets the highest level of memory and stops the system.

FIGURE 15. Model 221 RECORDALARM basic block diagram



High Speed Sequence

The first event in a HIGH SPEED sequence passes through the system in exactly the same manner as an event in a NORMAL sequence.

When the first event is shifted out of the first level of buffer memory, the memory has an output which resets the el time clock. When the start printout command from the highest level of memory initiates the printout program, the printout program removes the inhibit input to the el time gate and at the same time inhibits the real time output of the printout program.

When the change of state encoder receives an input prior to the end of a printout, it passes the data to the first level of memory and, at the same time, provides an enable input to the el time gate. The output of the el time clock passes through the el time gate to the first level of memory. When the data arrives at the highest level of memory it initiates a printout. The printout consists of the symbol CY, the number of cycles between events (elapsed time), the operation code and the three digit point address. If an event takes place before the el time clock advances one cycle, the elapsed time would be entered as 00.

If the number of incoming events is great enough to exceed the number of levels in the buffer memory, when all the levels of buffer memory are occupied, a circuit (not shown in the diagram) stops the scanner and inhibits the elapsed time gate until the first level of memory is empty.

When the first level of memory is empty, scanning starts. Since scanning is sequential, if more than one input point has changed state while scanning was stopped, the points which exceeded the capacity of the buffer memory will be printed in the order of interrogation.

Since the input circuits and scanner have a finite response time, there is a limit to the time between events for which sequence can be positively established. This is defined as system resolution. System resolution for a Model 221 is two-milliseconds (0.002 seconds). This means that in a high speed sequence, events at least equal in number to the levels of buffer memory will be printed out in true sequence provided they are at least two-milliseconds apart.

Since elapsed time is clocked to the nearest cycle, events occurring less than 16 milliseconds (one cycle) apart receive a 00 elapse time printout. Events which exceed the capacity of the buffer memory are printed out without an elapsed time printout and not necessarily in sequence, but no events are ever lost.

LOG PROGRAM

The log program provides an automatic check that the system is operating by printing out the real time (and the date, if included) at predetermined intervals (normally once each hour).

Referring to the block diagram, a log output from the real time clock is applied to the printout program. The printout program takes the contents of the date and time registers and enters them directly into the printer. When the data has been transferred and printed out, the printout program generates an end of printout signal which terminates the program.

OUTPUT TAPE

Figure 16 shows a sample output tape illustrating four types of readouts.

The first four printouts show events occurring in a NORMAL sequence. Each event was printed out before the next occurred. The first printout shows point 89 went into alarm at a real time of 14 hours, 24 minutes and 22 seconds. The second shows point 89 returning to normal at 14 hours, 24 minutes and 25 seconds. The third and fourth printouts show point 84 going into alarm at 14 hours, 24 minutes and 36 seconds, and returning to normal at 14 hours, 24 minutes and 39 seconds.

The next six printouts are a typical HIGH SPEED sequence. At 14 hours, 28 minutes and 36 seconds, point 84 went into alarm. 21 cycles later point 84 returned to normal. 41 cycles after point 84 returned to normal, point 89 went into alarm, and returned to normal 14 cycles later. 41 cycles after that, point 94 alarmed and returned to normal 11 cycles later. This sequence lasted for 128 cycles, or approximately two seconds.

The next five printouts show a HIGH SPEED sequence where the second, fourth and fifth events occurred less than one cycle apart. Since the minimum increment of elapsed time is one cycle, these events are printed out in sequence but with 000 elapsed time shown.

The last 12 printouts illustrate the "never lose a point" feature of LUNDELL RECORDALARM. The 12 events have occurred almost simultaneously in a Model 221 equipped with five levels of buffer memory. Since the first five events occur in approximately two cycles, the memory is filled almost immediately. The following seven fast events are held in the memories on the input point cards, and printed out in the order in which they are scanned. Since these events are not necessarily in real time sequence, there is no elapsed time printout for them.

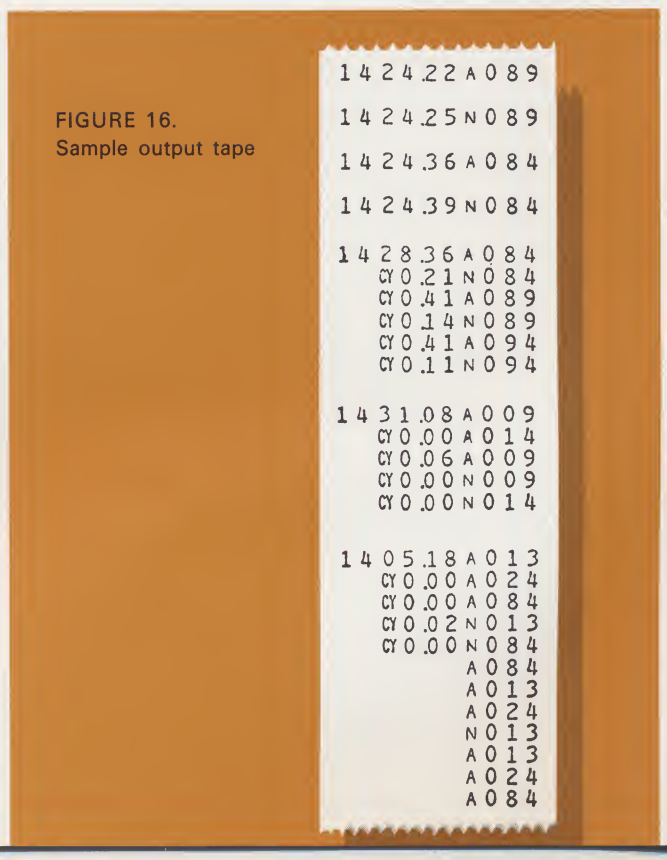


FIGURE 16.
Sample output tape

ORDERING INFORMATION

INPUT POINTS

Input point circuits are mounted five to a card, so active points and wired-in spares should be ordered in multiples of five. In arriving at total active points, do not include address 000, as this is used in the RECORDALARM test program. Input points are numbered in sequence starting at 001.

SHARED FIELD CONTACTS

Where field contacts are shared with a visual annunciator, the following should be specified:

a. the number of inputs which are both annunciated and recorded.
b. the number of inputs which are recorded only.
c. the number of inputs which are annunciated only (if any).
d. the groups of recorded points to be connected to a common annunciator point.
e. number of points supplied by D.I. Coils (if any).

BUFFER MEMORY LEVELS

Buffer memory is provided in increments of five levels. For power stations, 20 levels is usually adequate for one generating unit, and 30 for two. When in doubt, order the minimum number of levels anticipated, and specify wired-in hardware for anticipated expansion (in increments of five levels).

PHYSICAL SIZE

Contact LUNDELL in advance if a definite physical size is to be included on the order. Most RECORDALARMS consist of three or more cubicles. A typical arrangement is one cubicle for the logic, one for the point cards, and one for the input terminations. As the system expands, more cubicles are required for the point cards and input terminations. For estimating size allow one cubicle for the logic, one cubicle for point cards up to 500 input points, and one cubicle for up to 500 input point terminations.

POWER SOURCE

The input power source must be specified. Where two sources are used, the preferred and the alternate should be indicated.

PRINTER

The standard printer does not have a paper take-up reel. This is available as an accessory and should be specified if wanted. For operation from a dual source, the printer is supplied with an a.c./d.c. motor to provide uninterrupted operation. The standard printer is for desk top mounting. Panel mounting is available as an option. Printing speed is one line per second.

OTHER MODELS

Other models are available which provide:

1. Elapsed time printout to the nearest millisecond.
2. Teletypewriters as output devices. Tape punch and tape readers are available with these models.
3. English language description of input point.
4. Interfacing with computers.

LUNDELL will be happy to supply you with information on our other models and help you with your specific application problems or special requirements.

SPECIFICATION CHECK LIST

INPUT POINTS

_____ Active points

_____ Wired in Hardware for Future Expansion

_____ Points to Be Both Recorded and Annunciated*

_____ Points to Be Recorded Only

_____ Points to Be Annunciated Only

_____ Points to Be Connected to a Common Annunciator Point

_____ Points Supplied by D.I. Coils

_____ Points to Delay Return to Normal by _____ Seconds (1½ sec. standard)

MEMORY LEVELS

_____ Levels

_____ Wired in Hardware for Future Expansion

CABLE ENTRANCES (Select One)

1 Top Only
2 Bottom Only
3 Top and Bottom

PRINTER

With (Without) Paper Take-Up Reel

Desk (Panel) Mounted

Cable length (if other than 50')

POWER SOURCE (Select One)

1 95-130 v. a.c., Single-Phase, 60-Cycle
2 90-143 v. d.c.
3 95-130 v. a.c. Preferred Source and 90-143 v. d.c. Alternate Source
4 90-143 v. d.c. Preferred Source and 95-130 v. a.c. Alternate Source

OTHER

_____ Date Printout to be Included

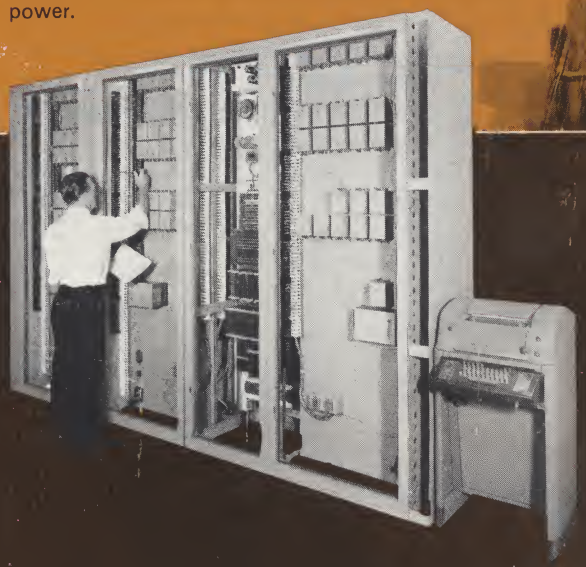
_____ Automatic Ground Detection to be Provided

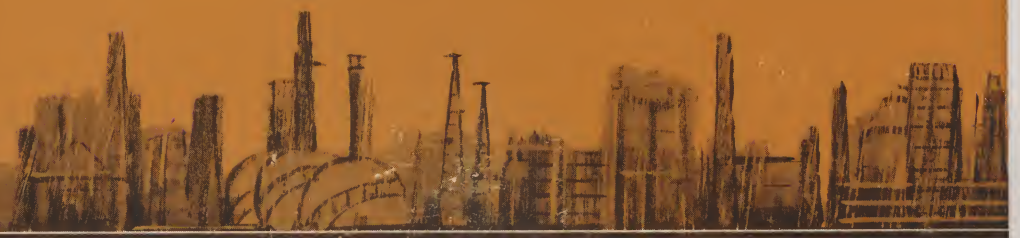
_____ Model 222 Manual Disconnect Terminal Assembly to be Provided

*If an existing annunciator, specify manufacturer and type or model number.

Typical STATALARM, providing a visual and audible indication of an alarm condition in the equipment being monitored.

Typical transmission substation data logger with front doors removed. This system logs amperes, volts, watts, and vars and is programmable. Printout is on a Model 28 Teletype and also indicates the direction of power flow and the sign of the reactive power.





LUNDELL SOLID STATE PRODUCTS

STATALARM— Annunciator

RECORDALARM— Sequential Event Recorder

DATA LOGGERS— For E, I, Kw, Kvars

LUNDELL

CONTROLS, INC.

2560 N. Elston Avenue • Chicago, Illinois 60647
Telephone: 312/772-8200

EXPORT DEPARTMENT
ENGINEERING BUILDING
205 W. Wacker Drive • Chicago, Illinois 60606
Tel: 312/726-7725 • Cable Address: ENOTS

Lundell representatives are located in 15 principal cities throughout the United States and in Canada. Ask for the name of the Lundell representative nearest you.

Bulletin No. SER-51567

Printed in U.S.A.